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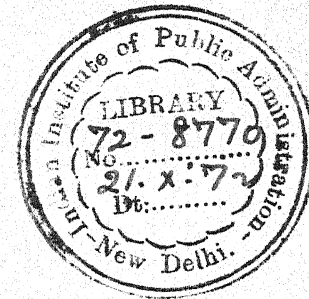
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FOREWORD

As part of the Executive Development Programmes, the Indian Institute of Public Administration conducts a number of training courses from time to time. One such programme has been an 'Orientation Course on Materials Planning' which was first conducted in 1969. Last year after presenting five 'Orientation Courses on Materials Planning', it was decided to conduct a 'Special Course on Materials Planning in Emergency' in the context of the situation in the country. Shri A. P. Saxena, Director (Training), Training Division, Department of Personnel, Government of India, who has been conducting these Courses has since prepared a paper on 'Materials Planning in Emergency'. Shri Saxena who has vast experience and many publications to his credit, has over the years made a special study of the subject. The present Volume highlights some of the key issues and problems which will need resolution before Materials Planning can be effective in an emergency. The Indian Institute of Public Administration has received many requests for the paper from time to time. We are accordingly publishing it with the hope that it would be of use to all those interested in the subject of Materials Planning, specially in the context of an emergency.

G. MUKHARJI
Director

INDIAN INSTITUTE OF PUBLIC
ADMINISTRATION

6TH JULY, 1972
NEW DELHI

PREFACE

The subject of Materials Planning though of recent origin has assumed increasing importance in the last few years. Since the declaration of emergency some time back, it is being increasingly recognised as one of the important determining factors for optimal achievement of national goals of production and self-sufficiency. It is often repeated that materials as an in-put should be available to the various sectors of the economy, not only in proper quantity and quality, but also at appropriate time. These requirements obviously impose the need for a degree of careful planning. Additionally, they also add a dimension of complexity to the planning process because of the large number of related variables which directly impinge on the subject.

In 1969, I was privileged to be asked to conduct an Orientation Course on Materials Planning at the Indian Institute of Public Administration. The Course was primarily aimed at middle level personnel from the Central Ministries, State Governments and Public Undertakings. Subsequently, in view of the encouraging response, the course has been presented a couple of times. Last year, in view of the prevailing situation in the country, it was decided that the Course should be restructured to emphasise the importance of Materials Planning in an Emergency. While designing such a special Course it became necessary to identify a few of the special features as relevant to an emergency.

The present Volume seeks to approach the subject of

Materials Planning in an Emergency, both at the functional level as also in terms of the various ingredients which will be necessary to make materials planning effective in an emergency. An attempt has been made to establish that a few important problems of materials planning in an emergency at the national level can be traced back to the problems faced at the level of industries or at the level of a project or a programme. In fact the inter-relationship is so marked that the micro-scale problems at the project level multiplied a number of times, constitute broadly the core of the problems of materials planning at the national level.

The importance of Materials Planning in an Emergency can be looked at from one more approach. During an emergency, lead-times available for replenishment are bound to undergo unpredictable changes. Consumption of materials will need to be curbed and the availability of finances for materials procurement will pose serious problems of planning. Today many of the industrial undertakings including the public sector carry heavy balances of materials. The dimensions of the problem on grounds of financial investment alone are perhaps sufficient to justify a close look at the subject of materials planning. It is, therefore, appropriate that materials planning is appreciated in proper perspective in the environment of an emergency, when availability of materials and financial resources are bound to be restricted.

The attempt to present some of the highlights of the subject as covered in the Volume is at best illustrative, and not exhaustive by any count. A detailed exposition of each of the constituent factors forming part of the overall planning of materials is outside the scope of the present Volume. The effort of the author will be amply rewarded if the present attempt succeeds in promoting a realistic appreciation of a few of the important issues and problems which form the core of the subject of Materials Planning in Emergency.

I am deeply grateful to Prof. G. Mukharji, Director, Indian Institute of Public Administration for encouraging me to conduct the Orientation Courses on Materials Planning and

in asking me to prepare this Volume. I am also indebted to Shri B. C. Mathur and Shri T. N. Chaturvedi for their guidance from time to time in this effort. I am thankful to Shri S. N. Swaroop, Training Associate for the Orientation Courses for his painstaking assistance during the publication of the Volume.

1ST JULY, 1972
NEW DELHI

A. P. SAXENA

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INTRODUCTION

THE role of Materials Planning in a national emergency has many important facets which merit detailed analysis and appreciation. A National Emergency (with or without hostilities) can involve the diversion of an increased part of the productive resources for national security and thus induces change in the composition, out-put and the allocation of material resources among the potential users. The national requirements in an emergency cannot be met solely by diverting to these needs increased quantities of specific goods already being produced to sustain the normal pattern of demand. Instead, it may become necessary to produce goods that were not previously produced, to increase substantially the out-put of some materials and goods already in production, and to decrease out-put of some other categories of goods. This could mean gearing a part of the existing facilities to different products and also to create new facilities and skills, involving new pattern of materials requirement. It is, of course, obvious that the requirements, including defence requirements, in an emergency have to be met expeditiously because long delays through any imbalance in materials planning cannot be tolerated as they will only endanger national security. Besides creating a marked pressure on requirements of materials, the urgency is further accentuated by rise in Government expenditure, and resultant financial strains. In fact, according to economists, it may also lead to a series of economic measures which have to be related to successful achievement of materials planning in a national emergency. Thus, the objective of materials planning during an emergency could be to preserve the equilibrium as far as possible in the supply, demand and planning parameters that existed prior to the emergency.

A number of approaches to attack the problems in materials planning during emergency can be envisaged, all aimed at sustaining and improving industrial capability to meet increasing requirements. Materials Planning can be so evolved that it can help to raise the productivity of existing plants, lead to expansion of existing plants, facilitate construction of entirely new plants and finally, bring to productive motion idle plant facilities. The uncertainties of defence requirements during an emergency no doubt pose complex problems in planning for materials leading to increased all-round need for materials. Assuming the emergency to include possible hostilities, one or more of the above steps may be needed for analysis of physical requirements of materials against (a) short-term and long-term future projection, and (b) material availability, both indigenous and foreign.

In a normal situation, material planning has broadly two valid objectives; physical and financial. The physical objectives are intended to ensure continuous availability of materials to various users and sections of the economy so that the productive cycle is not disrupted. The financial objective on the other hand, indirectly contradicts the physical objectives by demanding a level of investment in materials which is just enough and not more, subject to the physical requirements. The objective is thus to reduce investment in order to avoid locking up of productive capital. In a condition of emergency, the physical objective becomes pre-eminently crucial because the cost of disruption of the productive capacity can be prohibitive and even suicidal. Yet the financial objective cannot be entirely over-looked because in any situation of national emergency the availability of finances is bound to be restrictive. However, on balance, it must be noted that the need to sustain extra effort in an emergency would necessarily imply a stress on one set of objectives as against the other.

Here the dual objectives of efficiency and economy have to be continuously emphasised. Without effective, operational material planning, large quantities of materials may be needed to off set waste, losses, obsolescence, inefficient deliveries and unresponsive administrative apparatus. A heavy drain on

reserves of scarce materials will be necessary to overcome the leakage and waste of a poorly organised materials planning system. In a certain category of materials, it may be unavoidable to have stocks in excess of current needs and requirements. The problem has to be resolved by determining what portions of stocks of a material can be economically retained for future use and what portion in excess of foreseeable needs should be purged from the system. It is costly to maintain a material holding that is larger than necessary. Excesses would be a minor problem if the system could react expeditiously but the problem of excesses for want of planning, can continue as an inevitable consequence of emergency.

But the magnitude of the problem can be reduced by effective materials planning. Excesses can be determined by carefully developed yardsticks which may indicate at what period 'the cost of retaining an item is equal to the cost of disposing off it and reprocurring it at a later date'. The materials carrying cost includes such elements as cost of storage, space, up-keep, cost of issue, transportation, deterioration and obsolescence. What is the criteria or the yardstick for determining what quantity of material be retained for future use as being more economical than future replenishment by procurement. In fact, more than one criteria can be listed for consideration to include future availability and essentiality of material, the cost of carrying the material, deterioration, problems of procurement and the lead time in procurement. It may also be necessary to have a rough idea about the cost to hold the item until used as compared with the disposal value and the repurchase price.

Finally, the objectives of materials planning become crucial because of the inter-relationship and even conflict in the material requirements of the consumer, the producer and supplier during an emergency. All these claimants will need materials regularly and expeditiously because of the urgency of goals. The distinctions between governmental and non-governmental requirements will be largely academic as also the distinction between private and public sector which will also disappear because of the need for a total effort to optimise production during emergency. As

a consequence the objectives of materials planning in an emergency will require a re-adjustment of the normal regulatory procedures liable to be enforced for the purpose.

ROLE OF INVENTORY CONTROL AND SELECTIVITY

IT is necessary to appreciate the role of Inventory Control in this discussion. The quantum of inventories available in various sectors and sub-sectors of the economy is of tremendous significance to any materials planning effort. To ensure the most efficient use of available materials, it is necessary that the level of inventories holdings should be brought down to a proper balance with production requirements. Unless proper note is taken of inventories wherever located, while applying for materials, some units or sectors may pile up extensive stocks while others may be faced with shortages. Swift, concerted action is imperative to prevent unproductive accumulation of materials. Obsolete, surplus, slow-moving and non-moving material inventories must not only be identified and eliminated but the repetition of accumulations must be prevented.

The need for planning and controlling of inventories has been progressively recognised in the country and efforts have been made in the public sector to scale down inventories holdings to minimum working levels so as to reduce investments and ensure productive performance.* In an emergency this

*The Annual Report on the working of an Commercial Undertakings of the Central Government for 1969-70 (Ministry of Finance—Bureau of Public Enterprises) reports Inventory holding of nearly Rs. 1212 crores in respect of 81 projects with a total investment of Rs. 4301 crores. A Reserve Bank of India Study of the finances of the 91 selected Government companies for 1968-69 reports an Inventory Investment of Rs. 801 crores out of a total paid up capital of Rs. 1343 crores (Reserve Bank of India Bulletin, April, 1971).

Considering the importance of inventory control and the need to bring about sizable reduction in the inventories held by the Public Enterprises, two high level Committees were appointed to make in-depth studies of the

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becomes all the more meaningful because unproductive accumulation can create dislocation of available limited supply of materials. For this the size of existing inventory holdings of production units or sectors of the economy should be examined before allocation of materials in an emergency must be directly dependent on, and related to, the existing levels of inventories holdings available with an applicant.

The stress on Inventory Control as an integral part of materials planning in an emergency can also help to prevent and resist inflationary pressures. Inventory Controls and inflation controls present a good set of measures of a complementary helpful relationship. Prevention of avoidable inventories makes the available supply of material go further and thus restricts the inflationary pressure. The feeling that it is necessary to violate the price ceilings to get a fair share of materials will be also diminished when others are equally prevented from getting or retaining undue inventories. As a follow-up measure, effective ceiling on prices for a group of materials can also remove a primary cause of inventory accumulation by plugging expectations for future rise.*

Any integration of Materials Planning with Inventory Control will not be possible as long as it is not enmeshed with the concept of selectivity. First of all, a range of priorities are needed for various programmes and their material requirements

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inventories of certain selected enterprises and submit their recommendations to the Government regarding the levels and systems of inventory control. These Committees have so far examined 11 enterprises and have made important recommendations for controlling their inventories. The total inventories of these enterprises were Rs. 354.74 crores. The Committees were of the opinion that these were in excess by Rs. 115.17 crores. The recommendations of the Committee were considered by Government and instructions have been issued to all the enterprises to set up Inventory Control Cell in each Enterprise, to fix norms of inventories and get these approved by the Board of Directors and to report the inventory status to their controlling Ministries and the Bureau of Public Enterprises periodically. Compared with the previous year, there has been a reduction in the inventories of the Public Enterprises to the tune of Rs. 84 crores during 1969-70¹.

(Annual Report 1970-71, Government of India, Ministry of Finance, New Delhi).

*The promulgation of Defence of India Rules during the present emergency covers 'distribution and price of Essential Commodities'. See *Economic Times*, December 7th, 1971.

in an emergency. Very broadly, one extreme category of requirements may be conceived as of "highest national urgency" while another extreme category may be considered as important with "highest defence priority". Below these major categories, it would be desirable to develop a hierarchy of classifications in order to continuously provide guidance for implementing a materials planning system. The well-known A-B-C classification approach comes handy in this exercise of selectivity. If at least three categories or levels of materials planning activity can be established with reference to the level of emergency effort, the task can become relatively easier. According to one source, the category 'A', category 'B' and category 'C' items can be defined as under in conditions of emergency including hostilities :

1. *Category 'A' Items* : End items or components that have either high unit value or long lead-time, require critical skills or specialised production equipment, may be low unit value but with a high volume of demand requiring substantial production capacity, or finally; may require greater production capacity than is known to exist.
2. *Category 'B' Items* : Items having a low unit value with low or moderate volume demand which when considered with similar items will create a high volume demand. The category will also include individual items with low unit demand but of a unique nature. For these items materials planning will require analysis of basic production capabilities in the country rather than on an item to item basis. Finally, requirements of these items may be stated in general terms as against specific quantities so that the system of materials planning may not require more frequent up-dating.
3. *Category 'C' Items* : All items for which materials planning has to be done but are not included in Category 'A' or 'B' above will be included in this category. The materials planning needed for this category will be limited and will be confined to recoupment from the list of identified sources. It may be necessary to periodically

match the list of Category 'C' items with Category 'A' and 'B' items to ensure the appropriate placement of items in the different categories.

(NOTE : The term 'items' will include materials)

Categorisation in 'A', 'B', 'C' categories as a follow-up of the selectivity approach will be incomplete without mention of a further list of special items. It is quite conceivable that in the event of a national emergency there may be a need to plan for a group of materials which have unique planning features and in a way are dependent upon, and related to, more than one sector in the economy. Further, these items may have a very special relationship to certain defence objectives at a point of time. Obviously, planning for these special items will have an entirely different emphasis as against the well classified A, B or C items. In fact, for these items, continuous forward material planning may be necessary even before the inventory levels reach the maximum levels. Since these items will be normally items of long lead-time, high cost and special defence features, their planning and programming will have to be structured and reviewed continuously. The problem of levels of materials will be of continuing concern during emergency. The cost or the critical nature of an item has a definite bearing on levels, as does the distance of the user locations from sources of supply. Reliable and speedy communications, reliable transportation, and ready accessible reserves are basic factors which will help to reduce levels of supply and consequently financial outlays and the amount of storage space.

An important question remains as to who will undertake at a Central apex level the exercise of categorisation which should fit in with the over-all materials planning system at the national level. It is undenied that the highest policy echelons in the Government, Industry and Defence should be associated with this categorisation exercise. A Working Group for the purpose may be assigned the specific task of categorisation and detailed forward projection of the constituents of each category.

The high level acceptance of the categorisation is necessary for another reason, namely, that for any of these categories as

part of a national materials planning effort, a conscious decision may be taken to stock-pile a category or group of items. The purpose of this decision may be to acquire stocks of such materials in these categories that may be needed continuously during emergency and which have vital defence implication. This decision has also to take into consideration, whether a material may not be available because of partial or total loss of foreign supplies, or for any other reasons may not be available in ample supply. Efficient materials planning in an emergency should be flexible enough to take constructive note of such requirements which will be in addition to the normal A-B-C categorisation described earlier.

The categorisation of materials and the establishment of a stocking policy is intimately related to an evaluative study of the various industries involved in the entire process of materials planning. To be reasonably meaningful, the identification of categories of materials mentioned above must invariably reflect a potential identification of the concerned industries. For example, key industries in terms of their relative importance have their own requirements in an emergency. It will, therefore, be useful to have a carefully developed list of industries which need, produce or are dependent upon one, or more than one, category of items mentioned earlier. There may be a regional dispersal or concentration of such industries, which fact is relevant to materials planning at the apex level for achieving the objectives in an emergency. The identification of industries is related to and dependent upon categorisation of materials.

DETERMINATION OF PRIORITIES

THE effort aimed at categorisation of materials along with an evaluative study of the supporting industries, is also dependent on the whole question of 'priorities' as part of the overall Government policy during an emergency. Very broadly, the determination of priorities at the national level can be conveniently identified by an analysis of requirements and supply. A table can be attempted listing the requirements of all programmes both public and private, which need materials. Side by side, the estimates of availability of materials can also be listed and if the 'needs', lists can be met from the availability data, there is neither any need for allocation of 'priorities' nor there is need for any elaborate materials planning effort. However, in a developing economy like ours, where a massive effort is under-way to strengthen our industrial base, the estimation of requirements is likely to exceed the projection of supplies. Further, this gap becomes additionally somewhat indeterminate because of the inherent uncertainties of demand in an emergency.

The discussion of priorities is also related to the exercise of Government's powers to regulate the different production processes for meeting the needs of an emergency. Such an exercise of power is generally in terms of the relative priority of the productive processes. There can also be an exercise of Government priority in terms of distribution and allocation of resources. To some extent, this is already being done but it becomes more elaborate and even restrictive in any emergency.*

*As part of the Department of Internal Trade in the Ministry of Industrial Development and Internal Trade, the Civil Supplies Organisation acts
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For example, it may be necessary to direct the producers of, say, aluminium to supply the major users who have urgent requirements. There may also be a situation where the various departments and the ministries in the Government have an *inter-se-conflict* of claims regarding the allocation of scarce material. As part of an effective materials planning, the priority determination should be amendable to unambiguous interpretation so that such conflicts are resolved in the interests of national objectives in an emergency. Of course, this is easier said than done and it may be a fairly longish process of trial and error that may ultimately lead to the evolution of a mechanism (as part of material planning) to resolve such inter-ministerial or inter-departmental problems.

There are some details available as to how the problem of determination and allocation of priorities has been resolved by the Government from time to time. The common feature of these efforts has been the creation of a nucleus authority, which is charged to make allocation of materials and related items among the various major primary user sectors. The fact that the exercise of this power by the nucleus authority must emerge after careful mutual consultations at various levels is self-evident.

The exercise of regulatory controls by the Government over the distribution of a commodity can be best illustrated by a short reference to Steel. Control was introduced for the first

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as a coordinating unit between the Ministry of the Government of India and the State Governments/Union Territories for measures relating to containment of inflationary trend of prices of articles of Civil Supplies'. The organisation keeps itself continuously informed regarding *selected essential commodities* and has a special watch over the supplies and prices of 20 commodities of mass consumption, e.g., foodgrains, sugar, kerosene, etc.

The Civil Supplies Organisation is concerned with the Essential Commodities Act 1955. The total number of essential commodities under the Act during 1970-71 stood at 57. The State Governments and the Union Territory Administrations continued to *regulate the supply and distribution* of essential commodities as and when warranted by the situation.

Two control orders under the provision of Essential Commodities Act, 1955 were issued in December 1970 relating to Copper, Electrical Wires and Cables. The Essential Commodities (Amendment Act) 64 has provided deterrent punishment under the Act. (See : *Annual Report, Ministry of Industrial Development, 1969-70, 1970-71*).

time over the supply of steel in 1939 for War requirements. The control system introduced during the World War II survived without significant changes until 1964 because steel had remained in short supply. The aims of the control were to ensure the use of steel for purposes considered important for the common good, to keep prices from rising, and to ensure that all consumers in India, no matter how far from the Steel Plants, could obtain steel at the same prices. To achieve these objectives, the Government allocated steel to users, prescribed production programmes of individual plants and set prices of steel and regulated distribution. Structurally, this control system was organised through the Iron and Steel Control Organisation set up under the Iron and Steel (Control) Order 1956 which was issued under Section 3 of the Essential Commodities Act, 1955. The work of the Iron and Steel Control can be broadly divided into three parts :

- (A) To organise the planning, production and distribution of indigenous steel;
- (B) To issue licences for the import and export of steel in exercise of the powers delegated to it under the Control Order; and
- (C) Responsibility for the development of Iron and Steel Industry.¹

This control system was established at a time when the country consumed approximately one million ton of steel per year. In the early sixties, the consumption was five times more and the report of an Investigation Committee—the Raj Committee—disclosed various shortcomings.² On March 1, 1964, the Government withdrew its direct control over the allocation, purchase and pricing of certain steel products in which the supply position had eased. In respect of these items, most of the functions previously exercised by the Government were taken over by a Joint Plan Committee (J.P.C.) under the Chairmanship of Iron & Steel Controller, composed of representatives of five steel plants and the Railways. The Raj Committee highlighted the administrative imperfections in the face of steel scarcities, leading to disorder in distribution and high open market prices. While this Committee did not favour the

abolition of control, it recommended a number of steps to help rectify distortions in operating a control system. Acting on the Committee's recommendations, the Government in March, 1964 initiated a number of measures like allocation of priorities, setting up of the JPC and abolishing of stockists in certain categories.³

Since 1964, a number of administrative measures have been initiated from time to time to bring greater rationalisation and speed in the allocation and control system. While a discussion of all these steps is beyond the scope of present discussion, it is worth mentioning here the later revised distribution procedure, which abolished the allocation system. The new system announced in April, 1971 rests heavily on the priority allocation effort by a high powered Committee known as the Steel Priority Committee.⁴ The Steel Priority Committee is expected to regulate the dispatch every quarter, of all items of iron and steel by making the priorities allocation. 'To ensure that the available steel reaches the actual consumer, the distribution policy has been revised and streamlined and it has brought under Steel Priority Committee practically all categories of Steel produced by the main producers.⁵ Side by side, a number of structural changes have also been made in the office of the Steel Controller and an Appraisal Division has been set up to look after the plans regarding distribution of steel. Regional Offices of the Control Organisation are also being set up. As a further exercise of regulating prices the misuse of steel has been made penal offence under Section 7 of the Essential Commodities Act.

The above brief survey would reveal that essentially the regulatory controls have been unavoidable because of the continued imbalances between the supply and demand. A lack of reasonably accurate determination of steel demand for the future, a very difficult exercise has added to the problem. The studies of the National Council of Applied Economic Research⁶ have made a number of projections. The main estimates of future requirements were based on the so called end-use method, i.e., by multiplying the output in that sector. The steel content factors were developed on the basis of Indian experience

supplemented where necessary by foreign experience, mainly British and Japanese. To some extent these rest on expectations over the future growth of the economy. A few regional demand projections under auspices of ECAFE are worth mentioning here.⁷

Another useful model for Steel—A Regression Model—was developed by Johnson⁸ on the basis of indents placed on the Iron & Steel Control as an indicator of demand. In between these published studies, the Steel Ministry has also been conducting its own exercises and evaluations about potential and trends. The point to be noted, nevertheless, is that planning for steel (as part of material planning) against uncertain future projections of demand is a very difficult exercise with all its ramifications since steel is the major input for several industries.

There is also the important issue of ascertaining the *assumptions of demand* on which the exercise mentioned earlier should be done as part of overall materials planning. It is always a difficult effort to precisely determine what materials do we need during an emergency for defence purposes, or for other requirements of the economy. The accuracy of the estimates of requirements depend largely on certain assumptions about the non-civilian requirements in the economy as a whole. Once these assumptions can be realistically established, there is the next important, yet laborious task of developing a 'Bill of Materials' for various physical items; or in other words, of converting the descriptive requirements of the economy (including the defence effort) into quantitative measurements of steel, copper, aluminium, zinc, etc. The fact that one block of materials, say, Steel may have to be further sub-divided into a long list in terms of specifications (sizes/compositions) will further add to the labours of the exercise. Adequately detailed bills of material enormously simplify the process of material identification and subsequent procurement. In fact, it has been seen that in big complex plants the development of bills of materials is considered as the starting point for initiating the procurement cycle, particularly in cases where the procurement involves a number of imported materials. The Bill of Materials volume, as developed by Hindustan Shipyard for each individual ship on its

construction programme, can be cited as a useful example. Before each ship in a series is planned, the shipyard develops a very detailed and meticulous Bill of Materials, incorporating all the items starting from nuts and bolts to engines and propellers. In the transformer and other heavy electrical equipment industry, both in private and public sector such bill of materials are developed for all custom-made pieces, where the total supply lead-time runs to nearly 18 months or more. This is without doubt, the most crucial part of materials planning, not only because it is necessary to develop a master list of requirements of materials, but because it is imperative to ensure adequate balance and accuracy in the computations. It is possible that a number of estimations which go into the master sheet may err on the side of caution or may have built-in cushion for safety. These have to be located and ruthlessly rejected.

But how to achieve this rejection or elimination of superfluous estimations in the master sheet of calculations? One way can be to continuously review the master sheet or list systematically so that each and every item is examined objectively. Items which are of a critical nature or which belong to any special category as mentioned earlier, need to be specifically examined in-depth. Any changes in Governmental policies, programmes or priorities relating to individual items must be brought to notice. It is possible that through this effort the overall computation will become more realistic and reliable for use as basic information in developing materials planning.

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ORGANISATIONAL SET-UP

THE objectives of materials planning in an emergency, need determination of overall estimates of materials including their availability. It is necessary that a suitable organisational support is created to achieve these objectives. As the various ingredients of materials planning are put into effective operation, dislocations may appear for lack of efficient coordination and understanding in *ad-hoc* or make shift set-ups. Major consumers in the private and the public sector may protest about the quantum and the timing of allocation and release of materials. Some shortages, genuine or anticipated, may also be created. Some of these may in a way be inevitable. From the limited objectives and requirements of materials planning, any machinery that may be set-up for the purpose should invariably question justification of requirements to ensure the optimum, economic utilisation of materials. It will also need to check the estimates of materials requirements. At the same time, whatever agency undertakes this effort, *e.g.*, examination of justification and materials estimates, it is bound to face criticism for its disapprovals and rejection.

There will be an unresolved question whether such criticism can be obviated by studying the structure of administrative machinery and/or rectifying defects in the administrative techniques involved in the implementation of materials planning. It is a very difficult task, especially because it will cut both horizontally and vertically, the numerous Government and non-Government agencies, projects and consumers units. The difficulties will persist even after it is appreciated that the fundamental problem would be to make sure that the broad decisions allocating slices of materials for various requirements (including defence) are made effective through mechanisms on the control

of flow of materials from the economic system and for their distribution successfully. Centralisation of all authority in a single organisation or one big giant department can also be self-defeating because it may become an unworkable centre of leadership and initiative, without appropriate acceptance and powers of implementation.

The answer to some of the above difficulties may be to aim an integration of the different types of controls required for the materials planning procedures supported by a number of lateral organisations wherever necessary. This integration may be provided by a Central agency which can initiate a mechanism for integration, planning and policy formulation covering the broad range of materials. Responsibility for programming of materials availability may also be assigned to the central authority. Further, in order to ensure that integrated material plans and policies covering various production fields are smoothly moving in the direction of emergency operations, the central authority may need responsibility for supervising the overall material planning. The constituent control elements of materials planning at the national level may, thus be assigned to a group of agencies which may work in close liaison with the Central Organisation.

Since the early sixties, the need for an apex materials agency has been felt from time to time. It has been felt that our thinking and implementation in matters of organisation and procedures for determining requirements of materials, allocating materials and ensuring utilisation has not been thorough and complete. The problem were brought to the surface somewhat during 1965 conflict when there was an urgent concern to co-ordinate matters relating to scarce materials and non-ferrous metals. A Sub-Committee on scarce imported raw materials was constituted by the Government on 3rd September, 1965 concerned primarily with the arrangements for imported supplies of certain materials. Soon after the Department of Mines and Metals in the Government of India issued a 'Scarce Industrial Materials (Control) Order 1965'. Fortunately, the conflict did not last long and the urgency of these control measures were lost sight of.

But today, even before the present emergency, problems connected with the supply of key materials have become fairly complex indicating that the existing administrative arrangements are not wholly adequate. In view of the uncertainties of external aid, it will not be possible to make any commitments for import of important materials. Secondly, the extent to which critical materials can be obtained from countries with whom rupee trade agreements exist, is also limited. The system of administration and planning so far established for ascertaining requirements of materials and ensuring their flow, may not stand the test of time-phasing in an emergency. To state that the main priorities in the present emergency are defence requirements for exports and essential requirements for civilians economy, is not enough. It is necessary that the existing capacities requiring materials are optimally utilised, and where necessary should be converted to uses which have priority in the new context. Failure to do so will lead to defeat of the production objectives and export targets. In other words, starting from the materials end, it will be necessary to go for a more detailed programming of industrial production and materials so that one does not suffer for want of another. Clearly, an agency is needed which can stand outside the various Ministries and at the same time assist them and receive support in the task of materials planning.

A suggestion that there should be a Materials Planning and Allocation Board, was reportedly considered some time back. Today it appears that there is urgent need for such an organisation to bring together in an organised and coordinated manner several different factors, namely, flow of materials, scheduling, flow of resources and planning. Such a Board could take care of the overall planning and allocation, to the extent necessary, of key items which are in short supply and constitute critical bottlenecks in essential areas, which in turn determine progress in other sectors of the economy. In the interest of selectivity, the Board could deal only with the most important materials which other agencies in the Government are not equally or, in a better position to deal. The Board will be distinct from individual Ministries even though it will rely upon them for advice, information and such administrative function as may be

necessary to incorporate its operations and decisions. The Board should not be conceived as a large bureaucracy but to avoid dispersal of authority and excessive elaborateness in an organisation. Its central concern should be to enable key parts of the economy to produce optimally and in accordance with the emergency schedules. It should help to speed up production wherever necessary and to ensure that whenever there is a shortage, priorities are followed strictly supported by forward planning both of production and procurement. Again, only such matters would be discussed by the Board as are not likely to be dealt with elsewhere.

A Materials Planning and Allocation Board could effectively function through a number of Commodity or Material Groups. These Commodities or Material Groups would be responsible for intensive analysis and planning for a material commodity or group.

To start with, the materials should be divided into three broad levels : Major categories, Minor categories and Specification categories.

The Major categories would include materials, *e.g.*, copper, aluminium, zinc, nickel, etc., which ever are identified for planning. The Minor categories would indicate details like alloy steel, carbon steel, stainless steel, etc. Finally, each of the Minor categories would be further broken down into Specifications describing the forms and the shapes of the major category material, *e.g.*, sheet, strip, rod, bar, etc. This three-step categorisation will make it possible to refer and analyse materials in unambiguous terms.

The Commodity or Material Groups could have the following major functions :

- (A) Complete descriptive categorisation of specific materials in three categories as above,
- (B) Coordination and Computation of quantitative requirements,
- (C) Continuing procurement (dates and targets),

- (D) Supervision of stocks in, out or planned for the materials planning system on a quantitative and monetary basis,
- (E) Planning for replenishment of materials, and
- (F) Planning action leading to dispersal of un-wanted materials.

In addition to these broad functions the Commodity or Material groups may ensure that any type of duplication of materials is avoided. While it is recognised that there can be some duplication in procurement, storage and issue of the same material, this can be minimised by continuous control. Similarly, the Group could keep a watch on possibility of deterioration in storage, since almost any material will deteriorate to some extent in storage. The storage life of a material and the projected rate of withdrawal should be kept in mind. In the process of expeditious planning of material purchases, the Group may have to avoid administrative obstacles inherent in Government purchasing regulations. The urgency of the effort in an emergency has to be consistently brought to notice to all concerned.

A reference has been made elsewhere to the possibility of stock-piling of critical items. In addition to the points made earlier, such a group will analyse the decision regarding stock-piling by satisfying itself on the following items :

- (A) Military essentiality of the material,
- (B) Financial allocation available for procurement,
- (C) Expected normal consumptions,
- (D) Cost of material,
- (E) Lead-time involved in procurement.

The entire set-up of the number of Commodity or Material Groups and the apex Materials Planning and Allocation Board will have to operate under a system of management controls. It is not necessary to stress that for its justification, the material planning system should be responsive to control. It should lead to an effective, economical supply performance. *The economy of inventories, the economy of operating costs and the*

relationship of economy to performance standards should be appreciated. A number of quantitative controls will be necessary especially in regard to inventory management and control. It is beyond the scope of this discussion to discuss the extent or limitations of quantitative controls. It is enough to state here that these would be necessary as the activities of the Board and the Groups undergo refinement. Finally, financial controls in the background of governmental accounting are unavoidable. Statement of material transaction, financial accounting of material procurements and physical control of stocks will be unavoidable. However, the usual budgetary controls applied to this activity will need to be partly readjusted so that the task of material planning does not suffer for restrictive accounting procedures which may be usually applied in normal circumstances.

This symbolic diffusion of authority to a Board or Groups does not mean that the operating agencies in the field will have little discretion and will work under very tight regulatory controls. It is well understood that the operational performance of materials planning at the national level will generate many complex problems which will need early response and wide discretion for resolution. It is also necessary to stress that procedures need to be developed that will encourage continuous flow of materials without injuring the higher objectives of planning, programming and formulation of materials and production plans. The integration of organisational controls will be greatly assisted by such procedures arising out of easy and frequent contacts between the agencies and individuals, enabling them to work for effective materials planning.

5

NEED FOR DATA

THE entire effort of Materials Planning in an emergency can get seriously hampered for lack of adequate data and information relating to availability and demand of materials. Any effective direction of materials planning in an emergency will be impossible without reliable and timely data. The methods for collection and usage of the entire range of industrial statistics should, in the interest of efficient materials planning, ensure proficiently collected data which can be practically and quickly applied for planning. The supporting information should be as current as possible so that materials planning policies can be suitably determined, and policy decisions translated into administrative steps.

Our experience, limited as it is for want of published documents and studies, is that the type of data needed for an emergency generally, a d p p l i c a t i o n to materials planning in particular, is not identical to data generally collected in normal routine. In an emergency, as materials planning at the national level in all details becomes subject to objectives and directions of the Government, accurate and timely statistical data becomes a pre-requisite for planning even in areas that are less involved in normal working. This responsibility imposes new strains both on the availability and quality of data. Apart from being specific, accurate and timely, there are other desirable features also. Data must be obtained in greater detail on a broader basis, on a wide variety of areas and with a very short lead time between collection and utilisation.

It is not unusual, therefore, that in an emergency such desirable features are not forthcoming with the result that lack

of data seriously hinders determination of materials resources position. There is also little or no appreciation of the need for such data with the result that there is a scramble for data for developing a material policy with possible undesirable consequences. Such a scramble can lead to inept and inefficient procedures culminating in make-shift schemes and organisations which may later be difficult to improve and restructure. The whole effort would indicate a degree of improvisation with good intentions but inefficient consequences. Since Materials Planning in an emergency is directed to assist the production goals, it necessarily means requirement of data with all its inter-relationships in the economy.

A few important data sources currently available in the country are worth a mention here. The Central Statistical Organisation (C.S.O.) of the Department of Statistics, Government of India, publishes the Annual Statistical Abstract and an Annual Survey of Industries.* These are periodical publications and over the years have developed a degree of refinement even though the material is not fully current. The following publications issued by the Central Statistical Organisation during 1970-71 are worth mentioning here :

1. Monthly Abstract of Statistics.
2. Annual Estimates of National Product (1960-61 to 1968-69)
3. Monthly Production of Selected Industries in-India (including the Index of Industrial Production) Vol. XXI.
4. Advance Bulletins on Production of selected Industries of India and Index of Industrial Production.

*Annual Survey of Industries (ASI)—The census of manufacturing industries and sample survey of manufacturing industries were merged together and renamed as the Annual Survey of Industries which was started in August 1960 with the reference year 1959. The processing of data continues to be done at the Industrial Statistical Wing of the CSO in Calcutta for the census part of the survey and at the IST, Calcutta, for the sample part. The survey covers about 32,000 factories out of a total of a 25,000 registered under the Factories Act, 1948. All the factories employing 50 or more persons if using power, and 100 or more without power, are covered on complete enumeration basis. The remaining registered factories constitute the frame for the sample part and a third of these factories are selected for the purpose of enquiry. (*Annual Report 1970-71*, Government of India, Cabinet Secretariat, Department of Statistics, New Delhi.)

5. Brochure on Annual Survey of Industries 1967 (giving advance data summary results)¹.

The various publications of the Planning Commission, including the Plan documents, also provide a fund of source data used in the preparation of Plan projections. Here also one has to examine how current the available data is. The Directorate-General of Technical Development (D.G.T.D.) is another major repository of data relevant to industrial production, licensed capacities, etc. For some time past, it has been undergoing an exercise for developing an integrated information set-up for its own use but the benefits of this effort have not yet been published.* The National Council for Applied Economic Research is another important organisation which has over the years brought out a series of publications analysing in great depth the range of problems facing the Indian economy. Many of these studies have been sponsored or supported by Government and reflect a high degree of professional content. There are also a number of other non-Government agencies which have from time to time issued such studies. One of the financial papers, the 'Economic Times' has made pioneering contribution by publishing a number of valuable Research Surveys and Statistical Notes from time to time, pertaining to a variety of industries and also the Indian economy as a whole.

Yet the form and characteristics of available data remain an area of weakness if one were to attempt a framework for Materials Planning at the national level in an emergency. There are gaps in data on inter-industry relationships, on wholesale and retail inventories, on goods in transit and on material requirements for proposed output of key industries during an emergency. The fact that the available data lacks standardisation

*Information Gathering System in the Directorate-General of Technical Development : In pursuance of the agreement signed with the Indian Institute of Management, Calcutta effective from 21st February 1969, for designing, recommending and introducing a fully computerised Information Gathering System for the DGTD, the team from the I.I.M.C. has since submitted Phase-II report on the project which constitutes the design for the system. This phase of the report has been accepted by the Government and the team is now working on Phase-III of the project which consists of preparing the necessary computer programmes preparatory to the proposed system being put on trial runs. (*Annual Report 1970-71*, Government of India, Ministry of Industrial Development & Industrial Technology.)

and is not timely, adds further to the problems.

The basic characteristics of the requirements of data for materials planning in an emergency can now be summarised. It should provide a comprehensive knowledge of materials resources and availability which an emergency might impose. The resulting information must be well coordinated, comprehensive in character, accurate and amenable to tabulation for prompt use. The presentation of information should be such as to assure that a wide range of facts can be related to one another and to aggregates. The presentation should also cover definite time periods.

What type of machinery or systems should be envisaged for collection of data described above? It is obvious that it should not only provide information essential for some policy decisions but it should also provide the basis for (a) Administrative action and (b) Accountability of administrative policy as a whole. The machinery should work continuously and keep a precise watch on the development and requirements of material for industries with direct or indirect use in an emergency. The system or machinery will be incomplete without suitable methodological techniques for systematic collection of data and its use for materials planning in an emergency. Absence of such features in the data system can lead to delays in collection of data, create avoidable conclusion and loss of precious time.

Some of the above comments clearly point to the need for urgent study to be taken up to bridge the data gap in terms of the specific requirements during an emergency. These studies are all the more necessary because they will need a high degree of inter-departmental, inter-ministerial and inter-industry coordination. Take the case of some basic materials, *e.g.*, Steel, Aluminium, Non-ferrous metals, etc. At least for such a group of crucial materials, studies should be available on a current basis. It is no doubt possible to piece together from different sources the details on a few of these materials but the resulting effort will not be timely and will lack a degree of tested accuracy. Such studies can be attempted either by some departments

of the Government or they can also be usefully allocated to independent research organisations which have earlier produced similar work with distinction. The Hindustan Steel Ltd. has published a useful volume, "Statistics for the Iron and Steel Industry in India", in 1966 and 1970. The Department of Steel in the Ministry of Steel and Heavy Engineering publishes a quarterly 'Iron & Steel Control Bulletin' which is by far the best statistical summary for Steel. The National Council for Applied Economic Research had earlier published a series of continuing studies on Steel.² These studies have consistently provided an objective basis for discussion and planning.

The Ministry of Industrial Development has promoted a number of useful material studies, recently. A Materials Planning Cell is in existence in the Ministry. In fact, the work pertaining to Materials Planning, as envisaged in the Presidential Order of 25th March, 1966, was taken up by the Ministry during 1969-70. The Cell, was set up with a view to "attending to certain tasks insofar as industrial raw materials especially the scarce raw materials, are concerned." It has been felt that the Materials Planning Cell "could function usefully as a data bank for other Government departments as well as for agencies like the State Trading Corporation and the Mineral and Metals Trading Corporation which were importing raw materials on a large scale. With its present limited personnel resources, Materials Planning Cell is acting purely as a servicing agency for the various Government departments and corporations till such time as it can be strengthened to meet other needs."

So far the Cell is reported to have prepared studies in respect of the following non-ferrous metals : (1) Zinc, (2) Nickel, (3) Lead, (4) Tin, (5) Sulphur, (6) Rock Phosphate, (7) Tungsten, and (8) Copper. It is reported that data for the remaining items, *viz.*, Ferro-molybdenum, special steels, mercury and rubber is being collected from various sources, *e.g.*, Chief Controller of Imports and Exports, M.M.T.C., D.G.T.D., and other organisations. These studies are expected to be completed shortly.³

The Planning Commission also has been interested in conducting special material studies in the area of industry and minerals. For example, during 1970-71, detailed studies were carried out on the demands estimates of a number of petroleum products in different sectors of consumption. The indigenous availability and import needs of crude oil were also assessed in this context. Special studies were carried out in connection with the Planning Committee on Natural Resources (minerals). The Standing Committee on fine chemicals set-up a number of Sub-Committees for detailed work.

In regard to non-ferrous metals and other minerals the Metals and Minerals Trading Corporation (M.M.T.C.)—a public sector undertaking—has been periodically issuing 'Mineral Bulletin' which contains valuable statistical information. The Central Statistical Organisation has also recently taken steps in the area of 'Industrial and Mineral Statistics'.¹ The Indian Bureau of Mines also periodically issues 'Mineral Abstracts'—a useful statistical compilation.

The brief appraisal of the available documentation mentioned above is intended to indicate the variety and range of a few of the existing data sources in the country. It will be seen that a fair degree of coordination and up-dating will be necessary before any composite status status for a material can be established. In fact each of the sources cited has attempted data collection with its own specific objective in view, which is essentially different from an approach particularly relevant to materials planning in emergency. There is need, therefore, for a centralised coordinating point to undertake the task of analysing the extent of available data with a view to recast it for a material identified for planning study. Alternatively, the central point may even undertake the task of collecting its own data requirements as planned in terms of materials planning studies in an emergency. On balance, the first approach of utilising the existing sources appears more expeditious and economical as against the other approach which may be long drawn and expensive and need high level of skills to design and implement a meaningful data generation set-up.

REFERENCES

1. *Department of Statistics*, Cabinet Secretariat, Government of India, Annual Report 1970-71.
2. See for example the following studies of NCAER :
Reappraisal of Steel Demand, National Council for Applied Economic Research, New Delhi, September, 1963.
Long Term Projections for Iron & Steel, November, 1968.
Demand for Steel (1975-1985), August, 1971.
3. *Ministry of Industrial Development and Internal Trade*, Government of India, Annual Report 1970-71/1969-1970.
4. *Department of Statistics*, Cabinet Secretariat, Government of India, Annual Report 1970-71.

6

MATERIALS BANK AND
DETERMINATION OF REQUIREMENTS

The viability of any Materials Planning set up will ultimately depend on the confidence of a consumer, industry or project to assure itself regarding the timely supply of materials in appropriate quality and specifications. A continued uninterrupted flow of materials is thus an essential pre-requisite of materials planning in an emergency. To be effective, materials planning has to ensure that the physical operations are not allowed to suffer for imbalances in the supply flow. One of the ways to take care of these eventualities is the creation of a centralised Buffer Stock or a Materials Bank. In the event of a specific failure of supply of materials to a category of certified users, the buffer or the material bank can be utilised by the concerned units. The future unutilised material allotments receivable by the beneficiary unit can, in turn, be pledged to this bank on a revolving basis. The arrangement will ensure an un-interrupted production process and take care of possible disruptive eventualities that may be unavoidable in a situation where the demands are always likely to exceed the available material resources.

The size of the Materials Bank or the Buffer Stock has to be carefully studied. For critical and key materials at the national level, it would be necessary as part of the materials planning exercise to determine the quantum of Buffer stock, which should be continuously kept in view and replenished from time to time. A set of usage reports indicating the withdrawal from the material bank should be generated, to establish the extent of its use as planned. Of course, it needs to be well understood that a Materials Bank or Buffer Stock cannot be created for all

materials. In fact it is also not necessary. To be purposeful, the creation of the Buffer stock has to be restricted to as small a material list possible, preferably, half a dozen or so. There is a precedent in a slightly different context of such an effort by one of our well known public sector enterprise. The State Trading Corporation has announced some time back the creation of an Industrial Raw Materials Centre—IRMAC. This is a notable beginning and its performance can be studied to provide appropriate experience for the development of the procedures for the proposed Materials Bank.

It is important to clarify here that the physical location of the Materials bank is not important. The important thing is the regulatory character of the available stock which will ensure continuous availability of materials for optimising the production.

The concept of the Materials Bank can also be extended to cover a programme for stockpiling of critical materials which are of highest importance for defence and national security. A degree of stockpiling as mentioned earlier is unavoidable in scarce category of materials which are of foreign origin and are vital for industry. The programming for stockpiling as part of the Materials bank can be effectively done in stages. Firstly, the materials needing stockpiling have to be identified at the highest level. The determination of stockpiling objectives for these materials have also to be carefully delineated. The levels of holdings of stockpiling have also to be similarly determined. It would also be necessary to determine the procurement prices, if it is not considered necessary to leave the question of prices open. The provision should also be made for release of stockpile materials to industries in case the level remains stationary for long or exceeds maximum stipulated limits. Additionally, a number of other requirements may be necessary from time to time but it has to be appreciated that the Materials Bank providing the Buffer stock is the only appropriate locus for initiating stockpiling of a specified list of vital materials.

The specific determination of materials requirement for materials planning in an emergency raises a few questions. For

example, how specifically are the requirements of materials ascertained? How do the requirements originate? And who evaluates them? What is the process or mechanism of evaluation? What is the arrangement for resolving conflicting claims of claimants for materials in short supply? Some of these questions have to be dealt with for any realistic materials planning in an emergency. As it is, the determination of materials requirements in normal times is a difficult task as indicated earlier. It becomes all the more difficult in an emergency with uncertainty of material requirements and uncertainty of imports. Undoubtedly, requirements of estimates have to be frequently amended and supplementary estimates brought in, from time to time. A number of parametric factors, including the changing patterns of defence requirement adds further difficulty to the process of requirements estimation, and can even disturb the planning done at the earlier stages. By the very nature of materials planning, the initial estimates of material requirements will be far more general than estimates developed later. But at the same time, the more specific estimate can be developed earlier, the less work will be required later in materials planning. Materials planning thus has to reconcile the need for preparing detailed estimates of requirements as early as possible, and the complementary need for flexibility and ability to re-cast initial estimates.

The preparation of estimates of materials requirements is a complex effort. Materials requirements arise from national objectives, plans and defence requirements which are based upon estimations which are likely to be changed or prove wrong. The appreciation of these facts can help us to realistically see the problems in the determination of materials requirements. Over estimation of requirements can be an expensive mis-calculation as over-pitched estimates tie up money that can be put to better use in an emergency. The storage of materials for any length of time means heavy carrying costs of storage, maintainance and capital. There is a possibility that a part of the materials may deteriorate. Yet at the same time, under-estimation of requirements may mean crucial disruption in the production process defeating the very objectives of materials planning in an emergency.

A couple of well-known methods are used for evaluating materials requirement. The following four are worth mentioning. In respect of a specific material, however, it may be necessary to use all the four methods.

- (a) *Unit Weight Method* : This method is basically an engineering method and is used with advantage where production and performance levels are available in physical units. It requires a Bill of Materials, e.g., Steel, Copper, Aluminium per unit, which can be multiplied by production schedule of end items. This method can be used also for a number of consumption items, e.g., tracks, wagons, etc.
- (b) *Consumption Pattern Method* : This method is used wherever the out-put is measured in monetary values because commodities or products in a single group may be too heterogenous to be added together in physical estimates. Illustrative example are : engineering goods, machine tools, motors turbines, etc. A part of the supporting data can be obtained from published statistics so that the consumption pattern is not more than a year old from the time of estimation. For a few other materials, however, current data will be necessary.
- (c) *Derived Consumption Method* : This method is used for materials which are additive and inputs for other materials, e.g., Zinc for brass, Ferro alloys for steel. The additive factors are determined after mutual agreement and applied to pre-determined product mix and consumption requirements.
- (d) *Population Ratio Method* : This method is a variant of the first method, i.e., Unit Weight Method, and is applied to a part of the population that may be needing the material. A good example is reported to be of sleeping bags needing feathers. The number of sleeping bags required will depend on the population (users) likely to use bags, leading to determination of the feather content.

As a working proposition, the exercise of determination of requirements can be broken into a few phases. For example, the first phase may involve a review of the requirements determined by a preliminary effort. The second phase could take care of the formulation and review of materials planning extending several years into future. The final third phase will mean the development of annual or periodical material estimates. It will be noted that the suggested phase operation can be appropriately adjusted to a time-bound programme so that not only planning becomes a continuous effort, it also provides in-built provision for re-appraisal and refinement of estimates. The determination of a phased programme is by itself a detailed and time consuming exercise and will require careful thinking at the highest levels by all those concerned with materials planning. The idea of indicating the three phase approach is only to provide a tentative framework for future effort in this direction.

It is necessary to refer here to the publication 'Draft Fourth Plan—Material and Financial Balances, 1964-65, 1970-71, 1975-76' issued by the Planning Commission in September, 1966. The material balances contain balances of demand and supply for principal agricultural commodities and 31 selected major items of manufactures and minerals. The balances show the estimated demand in '65-66 and '70-71 by categories of end-use, the estimated imports and domestic production. The Material Balances approach adopted in the publication is related to the Input-Output table for the Indian economy in respect of 77 sectors. In this method, the demand of a specific commodity, mainly used as intermediate product, is arrived at by the application of the end-use analysis. The successive stages are : (a) identification of major consuming sectors and their sub-sectors, their current production and targets of production for the Fourth Plan, (b) determination of in-put norms in the past on the basis of observed data and adopting it for future in the light of relevant technical information, (c) calculation of materials requirements from the targets of production of using sectors and the in-put norms, and (d) estimation of addition to stocks and other uses. It was felt that the effort required for the preparation of material balances will also contribute to a better understanding of the structure of

the economy and to the identification and improvement of data needed for planning.

The efforts to prepare Material Balances have since continued and revised figures are reported to have been prepared in July, 1968 and early 1969. The latest projections are for 1968-69, 1973-74, 1978-79 and 1980-81 and cover practically the full range of materials of the 1966 publication.

MATERIALS PLANNING AND FOREIGN AID

The whole question of in-flow of foreign assistance is deeply related to Materials Planning. In fact, the subject has become very important recently with official announcements to do away with foreign aid as far as possible. The net aid in-flow in the last four years, 1967-68, 1968-69, 1969-70 and 1970-71 (provisionally) has been Rs. 863, 528, 454 and 334 crores respectively.¹ A part of this foreign aid has been used for import of materials which have indicated an increasing tendency in the past. The Economic Survey of the Government of India 1970-71 states: "During the last 20 years there has been steady growth and diversification of industrial capacity in India. This has endowed the economy with a capability to produce a comprehensive range of industrial products including a wide variety of machinery and equipment. There has been accordingly a shift in import requirements towards raw materials, components and spares. Much larger imports of such in-puts have now become essential not only for a fuller utilisation of the existing industrial capacity, but also subjecting the industrial sector to a greater degree of competition."

The Fourth Five-Year Plan, 1969-74, Document (1970) indicates as under the projected value of imports².

<i>Rs. in crores</i>					
<i>Group of Commodity</i>	<i>1967-68</i>	<i>1968-69</i>	<i>1973-74</i>	<i>1978-79</i>	<i>1980-81</i>
Metals including metal-ferrous ores and scrap	200	181	355	380	450
Total non-food imports	1568	1567	2190	2680	2950

In the last few years, the imports of raw materials and intermediate manufactures indicated the following trend³:

<i>Rs. in crores</i>				
<i>Commodity</i>	<i>1960-61</i>	<i>1967-68</i>	<i>1968-69</i>	<i>1969-70</i>
Raw materials/Intermediate manufactures	776.1	801.5	863.2	746.5

Out of the above Iron & Steel and Non-ferrous Metals accounted for the value of imports as given on pages 38-39:

These are by all standards fairly heavy. A later study of the Planning Commission has projected the following net import requirements during the Fourth Plan of a few selected metals.

<i>('000 tons)</i>	
Aluminium	152
Copper	369
Zinc	315
Zinc concentrate	457
Lead	311
Tin	40
Nickel	27 ⁴

Imports of base metals—Iron & Steel and Non-ferrous Metals—has been fairly heavy in the last few years. In regard to non-ferrous metal demands, the main problem is the limited availability of indigenous ores for strategic materials, zinc, tin, copper, etc. Other than aluminium, no other metal can indigenously meet our requirements even though several plants are in production and installed capacity has been increasing. According to a 1969 Planning Sub-group on Aluminium, our known deposits of bauxite ore are sufficient to produce aluminium at an annual rate of 5 lakh ton for 22 years. Since the supply position regarding aluminium is likely to be more comfortable, considerable support is being given for substitution of non-ferrous metals like copper, zinc etc. by aluminium. In the case of zinc, the overall demand appears much larger than the

IMPORTS OF IRON & STEEL

(Quantity in tonnes and Value in Rs. lakhs)

	1968-1969		1969-70		1970-71	
	Quantity	Value	Quantity	Value	Quantity	Value
Pig Iron & Ferro alloys	1,858	1,36	2,309	1,23	1,609	2,00
Cast Iron	3,306	1,62	1,454	80	1,626	72
Mild Steel	3,66,492	58,25	3,45,282	58,10	5,51,132	100,10
High Carbon Steel	36,088	6,58	31,836	5,88	71,454	15,45
Alloy Steel	35,874	15,90	28,286	12,16	64,824	25,81
Steel Castings & Forgings	8,349	3,83	7,231	3,93	8,015	4,34
Iron & Steel Scrap	13,469	1,22	6,599	91	7,428	76
Total :	4,65,436	88,76	4,23,087	83,01	7,06,088	1,49,18

Source : DGCIS data re-arranged.

IMPORTS OF NON-FERROUS METALS

Division 68 Non-Ferrous Metals	Imports		
	April to March		
	1970-71 Rs.	1969-70 Rs.	
681 Silver, Platinum and other metals of the platinum group	60,57,466	27,09,635	
682 Copper	60,20,24,054	47,39,96,928	
683 Nickel	12,61,71,353	2,81,66,584	
684 Aluminium	3,35,12,242	1,50,91,430	
685 Lead	9,77,68,487	6,44,11,589	
686 Zinc	21,96,83,198	8,25,31,945	
687 Tin	8,10,49,512	6,29,44,599	
688 Uranium and thorium and their alloys	—	—	
689 Miscellaneous non-ferrous base metals employed in metallurgy	2,30,97,394	1,55,99,645	
Total of Division 68	119,63,63,706	74,53,99,645	

Source : Monthly Statistics of the Foreign Trade of India Vol. II ... Import, March, 1967, Government of India, Department of Commercial Intelligence and Statistics, Calcutta.

indigenous output and the demand is growing. In respect of Steel, major materials imported are high carbon steel, alloy and tool steel and spring steels. Alloy steel has accounted for a large part of the material import Bill. According to D.G.T.D. Report 'indigenous sources of production have been developed and it may be possible to economise imports by standardisation of various types of steel used and by reducing the varieties'. It is reported that in the case of alloy and special steel, already variety reduction has taken place through standardisation and the number of varieties have been brought down from 1500 to 150.⁵ However, further work needs to be done to regulate the saving of foreign exchange by resorting to import of more basic items of steel instead of final qualities.

Naturally, a question arises as to how materials planning should be done for these important materials against the background of diminishing aid. The document 'Approach to the Fourth Plan' presented by the Planning Commission in May, 1968 clearly stated 'A major objective of the Fourth Plan is to move towards self-reliance as speedily as possibly. A process of development sustained by continuous foreign aid cannot be healthy. The attempt, therefore, should be to reduce foreign aid (net of interest and loan repayment) to about half the present level by the last year of the Fourth Plan. This will entail consolidated effort both in reducing imports and increasing exports'.

The latest comments by the Prime Minister and the Planning Commission indicate very clearly the desire of the Government to reduce foreign aid as far as possible. Clearly, the problem for planning for materials in this background becomes additionally difficult when viewed in the context of the present emergency. Taking the case of Iron and Steel and non-ferrous metals only, it is not necessary to overemphasize their crucial importance for industrial production and defence preparedness during an emergency. The whole subject of materials planning thus assumes high priority and it is hoped the subject will be analysed well enough to take care of the problems.

According to well known experts, 'the impact of aid

diminution will be felt only over the long run in that aid in the pipeline will then out . . . ' Since there is not much chance of stepping up exports to fill the gap, imports will need to be cut in fairly drastic manner. The reliance of some industries for raw materials from Western sources will have to undergo a big change. According to one correspondent, 'A close look at the kind of imports that are aid financed will show that except in some cases, such as crude oil and non-ferrous metals—much of the imports can be substituted by efficient operation of established capacities'.

This brings us to the important question of import substitution. The developing situation, as far as relevant to materials planning, will mean stress on import substitution and development on the basis of self reliance. Suspension of foreign aid in 1965 conflict had a significant promotional effect on Import Substitution. The stress on import substitution however did not sustain long because of massive maintenance imports and aid after devaluation (1966). In the present conflict, however, things are different. In an emergency, the basic task of import substitution will be to counter-act the foreign exchange constraint on development and support materials planning. Import substitution should be directed towards relieving the foreign exchange difficulties (likely to be caused by aid adjustments) by the reduction of imports on one hand and diversification and strengthening of the production on the other, so as to make it more self-reliant.

The critical shortage of important raw materials and lack of foreign exchange to lavishly import should give a new sense of emergency to the need for economy and efficiency in their use, for planning and for the development of substitutes. While no country in the world can be self-sufficient in respect of its material requirements, the strategy of development and the minimum needs of import substitution demand, that early attention should be paid to materials planning in this context. Through modification and adaptation, wherever necessary, maximum utilisation of indigenous material can be ensured. Import substitution does involve a good deal of development, research and study of new designs and materials which the

Indian engineering industries should be capable of attempting.

Government thinking on import substitution as part of materials planning needs to be more aggressive according to some sources. There has been *ad-hoc* thinking from one licensing period to another, and regulatory controls have been frequently promulgated without too much advantage. It may be recalled that the idea of import substitution finds a place in the Government's Industrial Policy Resolution of 1956 but for one reason or other consumers and importers have been able to delay the achievement of substitution as part of materials planning. A suggestion was made some time back that there should be an Import Substitution Board⁶ which should work out in collaboration with concerned Governmental agencies, list of materials to be substituted somewhat on the following lines :

1. For all items to come (a) in the immediate future, (b) from long range point of view,
2. for times of emergency, and
3. for defence purposes.

This can be a useful effort and perhaps the Government, somewhat on similar considerations appointed a high level Committee on Import Substitution which was set up during 1969 to take stock of work done in this field and to give directions for future programmes of work. During 1970-71, the D.G.T.D. is reported to have undertaken a further review of the efforts in the field of import substitution. This Review reported that while estimated savings in foreign exchange in 1967 as a direct result of import substitution was Rs. 35 crores, the savings in the foreign exchange during the year 1968-69 were estimated at Rs. 75 crores per year. According to the Annual Report of the Ministry of Industrial Development (1970-71), it has been emphasised on all concerned to take urgent steps in reducing imports to the barest minimum possible and achieving maximum utilisation of indigenous capacity. These steps of the Government have been supported by the various tariff and quantitative restrictions initiated from time to time. In an emergency, the increasing pressure on foreign exchange availability and the

need for maintaining the productive processes optimally utilized the whole question of import substitution deserves urgent attention. Only the other day, the Union Minister for Industrial Development stated that the entire problem of import substitution was being tackled on an emergency basis and that it has been decided to identify as many import substitutes as possible.⁷ It was also indicated in the context of exchange problems that "immediate impact of the stoppage of a large chunk of aid might be to create certain transitional difficulties, in the long run substitutes found for imports would give a fillip to increase indigenous production of a wide range of industrial products". This massive search for import substitution is a very welcome development and clearly recognises the need for this effort for effective materials planning in an emergency.

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4. *Papers relating to Quantitative Aspects of the Indian Economy*, Perspective Planning Division, Planning Commission, New Delhi, July 1968 (Mimeo).
5. *Directorate-General Technical Development* (Ministry of Industrial Development), Annual Report, 1969.
6. *Import Substitution—Is it a mere Slogan?* Manmohan Singh, 'Economic Times', November 3, 1968.
7. See 'Hindustan Times', 3rd January, 1972.

CONCLUSIONS

The effective implementation of Materials Planning in emergency will thus involve the need to conserve, limit or augment materials supply. This may be necessary in varying degrees depending on the awareness of production goals of various sectors and sub-sectors of the economy. Smooth materials planning alive to the production targets will imply a high degree of coordination and expeditious decision making. Long lead-time associated in getting 'clearances' and 'approvals' will need to be radically altered. This will involve clearly a data capability to translate materials planning into an operational system during emergency. The data characteristics needed for this support have been earlier indicated. It is worth noting here that as and when the data capability gets improved with the passage of time, it may eventually need the support of Electrical Data Processing facilities. It may or it may not involve the use of a Computer but one can reasonably conclude that computer facilities in a subsequent stage of development would be highly desirable.

It should be well understood that detailed, centralised control and planning of materials especially in the environment of an emergency is difficult. In fact, a full detailed centralised control plan for materials may well nigh be impossible because to attempt or to impose detailed controls on materials in-put flows and out-put can easily lead either to the break-down of the system or to the creation of a rigid, inflexible and inefficient set-up. The need for providing flexibility in procedures and organisation set-up has to be consistently kept in mind so that new directions and adjustments available from time to time can be integrated into workable materials planning. Flexibility

should also be allowed so that the various decision points all along the line should be able to apply their own judgment subject to the achievement and limitations of over-all goals and sub-goals. Delayed decisions based on historical data used for prolonged examinations can be self-defeating.

Even otherwise, it is fairly clear that a centralised control system is also costly in many ways. Firstly, it leads to proliferation of paper work both in the Government and non-Government sectors. It may also lead to dependence of producers and consumers of materials on Government agencies. There is also danger of creating a vast bureaucracy that may go on and on, interpreting and applying various procedures and regulations. While an apparatus employing a number of personnel is unavoidable it has certainly to be kept within the limits of adequate efficiency and advantages. It does not take long for planning procedures developed with the best of care to degenerate into 'Controls'—a term which by its very nature connotes in efficient centralisation and lack of action.

The need for suitable training programmes and courses in Materials Planning should be recognised and implemented for a better appreciation of the subject. It is difficult to prescribe rigidly the content for such training programmes, even though the need for such training is increasingly becoming important. Today a number of control tools and techniques have been developed, e.g., identification of material levels, inventory planning and selective inventory control, application of tools and techniques for determination of material requirements and analysis of procurement lead times.

In this connection the training effort made at the Indian Institute of Public Administration, New Delhi may be mentioned. Under the Executive Development Programmes, the Institute has so far presented five Orientation Courses on Materials Planning. These courses started in July, 1969 have so far covered nearly 150 senior officers in the Central and the State Governments as well as the Public Sector, as indicated at page 46. The purpose of these courses has been to present a broad overview of the subject of Materials Planning at three distinct levels,

	Total	Central Govt.	State Govts.	Public Sector Ent.
1st Orientation Course 21-27 July, 1969	28	17	3	6
2nd Orientation Course 2-7 February, 1970	36	14	6	16
3rd Orientation Course 19-23 December, 1970	30	12	9	9
4th Orientation Course 15-20 February, 1971	31	21	3	7
5th Orientation Course 26-31 July, 1971	27	19	5	3
Total :	152	83	26	41

i.e., the Project Level, the Industry Level, and the apex National Level. An attempt has also been made to stress the inter-relationship of inventories with the subject of Materials Planning at the micro level. These courses have been well received and the feed-back obtained from the participants has indicated a fair degree of appreciation. In fact the Special Course on 'Materials Planning in Emergency' sponsored by the Indian Institute of Public Administration (January, 1972) was an off-shoot of the experience gained in the presentation of the earlier five Orientation Courses.

The area of cost effectiveness of materials planning, though new, needs appreciation. Traditionally, the emphasis in an emergency will be the effectiveness of material availability rather than the cost to supply materials and to make the materials available when and where needed. In an emergency, it is a fairly desirable emphasis because it is clear that failure for example to provide critical materials for security can be disastrous. It is no wonder that in these cases the cost factor is likely to slide to the background. However, it is being increasingly accepted that cost effectiveness can still be attempted within the parameters of national security requirements and preparedness. In some countries, cost reduction programmes for 'defence preparedness' are being increasingly stressed. Large

reductions in materials requirements have been made possible by sharp contraction of the time required to procure, produce and deliver materials, by discarding old methods under which needlessly stocks of materials are required as an insurance reserve, by developing forecasts based on more scientific computations, by the use of improved projections of future requirements. By constantly challenging the assumptions of demand and requirements, unnecessary quantitative and qualitative features can be controlled as part of effective materials planning. In view of pressure on financial resources, the above methods can become key factors in promoting successful materials planning in emergency.

Materials planning in an environment when a number of factors, determinate and indeterminate, impinge on the economy can never be perfect. The sheer size of our problems and the imponderables will make it impossible to imagine it working all the time on rigid schedule. But all the same, an emergency requires a set of minimum objectives to be fulfilled which an effort like materials planning is capable of providing. Absence of materials planning at the national level will, on the other hand, lead to inconsistency, expediency and wasteful paper work without any consequent benefit to the economy. It will at least provide a means to anticipate problems relating to the availability of materials, and hopefully will also provide plans to meet such problems. Too often, in the past recourse had to be taken to *ad-hoc* measures, which undoubtedly impede industrial activity in a few sectors. Such possibilities can be avoided by a national effort of materials planning during an emergency.

